

EXPOSURE TO NITRATES - PROFESSIONAL HAZARD OR WORK ACCIDENT IN FOOD INDUSTRY WORKERS. CASE REPORT OF A COLLECTIVE INTOXICATION

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Abstract

Nitrates and nitrites are substances in the type of additives used in food industry mainly as preservatives and to enhance the red colour in meat products. These substances are of a certain level of toxicity, falling into the group of methemoglobinizant toxics, as they can lead to death. Voluntary intoxications with such substances are very rare, while those that happen more frequently are the accidental one, caused by their mistaking for alimentary salt. The aim of this paper is to present a collective intoxication of 4 employees of a slaughterhouse in Bistrita, following their consumption of various quantities of sodium nitrate, which led to the death of two of them. Toxicology results confirmed the initially alleged diagnostic and allowed for the progress of the judiciary investigation for collective work accident.

Key words: sodium nitrate, methemoglobinizant toxic, collective poisoning, work accident.

INTRODUCTION

Food additives are substances either from natural origin or from chemical synthesis that are not consumed as food in themselves, nor used as ingredients of food, and are intentionally added to food in order to help preserving, colouring, or modifying its taste (Mencinicopschi, 2011). They are classified in the European Commission database in the chapter on food safety and are known in the current speech as "E's". In this database are indexed nitrates and nitrites as follows: E 249 potassium nitrite, E 250 sodium nitrite, E 251 sodium nitrate, E 252 potassium nitrate, and there is a specification that they are not recommended for daily use. (Mencinicopschi, 2008). Their action is to preserve meat and dairy products and, in the case of the sodium nitrite, to secure meat colour. The antimicrobial action is actually performed by the nitrites, while nitrates are useful because they change into nitrites due to the enzymatic action (Ciurea, 2011). In fact, the natural sodium nitrate, known in the Middle ages as Chile saltpetre as well as the potassium nitrate, known as India saltpetre have been historically used as food preservatives. The way nitrites enter the body is the digestive track. The toxic action of the nitrates expresses by irritative symptoms of the digestive tract, especially of the gastritis and enteritis type. The reduction of

the nitrates to nitrites takes place under the action of the bacteria in the large intestine, and nitrites resorption determines the emergence of the methaemoglobin in the circulating blood (Mogos, 1978). By means of their oxidant action, nitrites change the bivalent iron in the haemoglobin molecule into trivalent iron, thus resulting methaemoglobin (Belis et al, 1995).

The changing of the haemoglobin into methaemoglobin makes the oxygen transportation function of the former impossible, which leads to the appearance of a transport hypoxia of the anaemia type, in a qualitative form. (Perju-Dumbrava, 1999). The cell toxic effect of the nitrites is weak, the main action modality being the anoxic one (Dermengiu, 2002). Death occurs over a methaemoglobin level of 60% (Belis, 1999). The minimum lethal dose in the case of nitrates varies, a quantity of 30 g leads definitely to death, although the same effect can be triggered by a smaller amount, such as 5-10 g. The lethal dose in nitrites is much smaller, death can occur following the ingestion of 2g of substance. As far as their organoleptic properties are concerned, nitrites and nitrates are white, crystalline, water soluble substances, nitrites tasting slightly salty (Banciu, Oarda, 1964), which explains their being mistaken for kitchen salt. The occurring anatomopathological lesions are under the form of the fawn colouring of the teguments and blood, and haemorrhagic areas on the digestive tract (Belis et al, 1995). It is the toxicology exam of the biological evidence that settles the diagnosis.

CASE REPORT

A group of four trained workers, employees to a Bistrita slaughterhouse, were admitted urgently to the County Emergency Hospital, accusing dizziness, headaches, nausea, diarrhea. They are transferred to the Intensive Care Unit, where they get non-specific support treatment for their vital function: hydration, oxygen therapy, vitamins. One of them dies on the same day, so there follows a post mortem. The exam reveals, in the male, 51-year, IIIrd degree obese corpse, such signs as: brown cadaveric lividitys, chocolate-coloured blood, brown muscular tissues, cerebral oedema, discrete haemorrhagic petechia on the mucous membranes of the digestive tract, organ stasis. The Intensive Care unit was informed about a suspicious intoxication with nitrites in the view of initiating the specific treatment. The investigation data were not relevant enough, thus being needed a second police investigation on site and repeating the cross-examination. The above revealed that the four employees had had lunch about 3 p.m., when they ate some chunks of the meat they had been processing, that they spiced with some crystalline white substance from a bag that was in a shed. They were

accompanied by a fifth worker, who declined their invitation to eat meat, as it was a fasting day and he had brought something more appropriate from home, so he neither ate nor did he use the white powder. The on site investigators didn't find the bag described by the witnesses, and the owner of the business claimed not to have had nitrates or nitrites ever. Later on, the witnesses reviewed their statement, and said they hadn't actually seen any white substance bag, but had been told about it by the deceased worker, who had brought himself the substance they were to mistake for salt.

During the second day, a second worker dies, and his post mortem reveals much the same macroscopic anatomopathological diagnosis as in the former case. The toxicology exam confirms necroptic suspicions, and methaemoglobin was positive in both deceased bloods. Unfortunately, at that time there was no possibility of quantitative dosage of the methaemoglobin, so it was only qualitatively highlighted.

The first deceased had an alcohol level of 0.35 ‰, while the second didn't get such test, on account of the longer time passed between admission and death. Both cases were declared violent deaths, caused by the anoxic anoxia of transport, following the methemoglobinemia, most probably triggered by the acute nitrite intoxication. It was considered that the cause of death was the nitrites as the usual amount of salt used for a meal is of 1-2 g, that being closer to the lethal dose of nitrites than of that of nitrates; moreover, it is the nitrites that taste slightly salty, which makes them more likely to be the object of such confusion.

The two survivors were discharged from hospital after five days, with no sequels. From a judiciary point of view, due to the fact that the material evidence substance had disappeared and the toxicology exam was inconclusive, on both technical and material grounds (it is not legally possible to commission a laboratory outside the legal medical network) and since the witnesses' accounts converged, although differing from those given first, the case was closed, not being considered as a work accident, because there was no evidence that the people in question had got poisoned with a substance taken from the very premises of the business where the intoxication took place.

CONCLUSIONS

Nitrates and mostly nitrites are substances with a high thanatogen potential in case of ingestion, and the workers in the food industry can be exposed to their action.

In the case of workplace accidents produced by intoxications with substances that are difficult to identify straightforwardly because of the limited technical conditions, it can be enough to identify the effects

produced by the respective toxics in the body in order to conduct the therapy, but at the same time, not enough to conduct a criminal investigation.

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